THE NEW IDEAS IN METEOROLOGY

There have been great advances in the science of meteorology during recent years which have completely revolutionized our conception of the structure and mechanism of the atmosphere. Dr. G. C. Simpson devoted his presidential address to section A (mathematics and physics)[1] to a description of the chief of these advances, dividing his address into four parts, each dealing with one of the new ideas on which these advances are based.

(1) *The thermal stratification of the atmosphere.*—By using the idea of entropy, Doctor Simpson showed that the atmosphere can be marked off into nearly horizontal shells which have the peculiar property that air which starts in any one shell can not be transferred to any other shell and remain there in equilibrium unless heat is added or subtracted. Thus, in all atmospheric motion in which heat is neither added nor extracted, the air must travel along the shell in which it started. These shells act like physical restraints to the air, tending to prevent its moving in any but an almost horizontal direction. Occasionally the air contains sufficient water vapor to supply, when it condenses, the heat necessary to pierce the thermal stratification, but these occasions are practically confined to thunderstorms and to the rain squalls in the doldrums. The thermal stratification of the atmosphere prohibits the ascent of warm air at the Equator and descent of cold air at the poles, which has generally been considered to be the cause of the general circulation of the atmosphere, on the analogy of a gigantic hot-water system.

(2) *The mechanism of the atmospheric heat engine.*—The old idea that the energy received from the sun is converted into the energy of winds by the air near the ground being warmed and rising, like the hot air in a chimney, is obviously unsound. The thermal stratification prevents this action in all but exceptional cases. In place of this mechanism a new one is introduced. Masses of air from equatorial regions and from polar regions are brought side by side in middle latitudes. The cold-polar air tends to subside and flow under the warm equatorial air which rises up the flank of the cold wedge which the polar air presents to it. When cold and warm air which were originally side by side react in this way, there is an appreciable lowering of the center of gravity of the two masses taken together. Thus potential energy is released and appears as the energy of winds.

(3) *The significance of surfaces of discontinuity in the atmosphere.*—The surfaces at which relatively cold and warm masses of air meet and slide over each other, as just described, can easily be recognized on meteorological charts and by observations in the upper atmosphere. It is found that nearly all cloud is formed at such surfaces. Doctor Simpson discussed the conditions under which these surfaces of discontinuity can be mainted for long periods, and their significance in weather forecasting.

(4) *The origin and structure of cyclones.*—The recent work of Bjerknes and Exner was described, according to which cyclones are formed where masses of air of polar and equatorial origin are brought together, and readjustment takes place in the manner described above. The old idea of a cyclonic depression being a kind of chimney drawing air in below and delivering it at the top can no longer be held.

These new ideas have had a far-reaching effect on the practical application of meteorology. Instead of the old empirical method of forecasting, the forecaster now has much more knowledge of what may be called the anatomy of a depression. He searches his charts for indications of the surfaces of discontinuity and examines the characteristics of the iar masses to see whether they are of polar or equatorial origin. This has all resulted in greater confidence on the part of the forecaster, a confidence which is frequently justified by remarkably accurate forecasts.

[1] Of the British Association for the Advancement of Science, Southampton meeting, 1925. This abstract reprinted from Nature, August 29, 1925.

METEOROLOGICAL SUMMARY FOR SOUTHERN SOUTH AMERICA

[Reported by Señor J. B. Navarrete, El Salto Observatory, Santiago, Chile. Translation by B. M. V.]

The month of September was rainy, especially during the whole first fortnight.

At the beginning of the increase of solar activity, which began toward the end of August, causing intense hot waves, a violent electrical storm developed about sunrise on the 1st of September over the central zone of Chile; it appeared first off the coast opposite Valparaiso about 2 o'clock in the morning. It passed Santiago about 4, Los Andes about 8, and broke up about midday near Caracoles. The path of the storm was clearly parabolic and in a general sense extended from west to east.

On the following days (2d and 3d) an important low-pressure control dominated the southern part of the continent, and rendered unstable the atmospheric conditions in the southern provinces of Chile.

On the 4th, it rained from Valparaiso to Chiloe, the maximum precipitation, 70 millimeters, being observed at Valdivia.

On the 5th, a large cyclonic depression appeared in the west (coinciding with a maximum of the solar constant); the fall of pressure affected the central and southern zones simultaneously, and caused a violent rain and wind storm from Aconcagua to Valdivia; on the 6th the depression was centered off the island of Mocha. It rained hard from Coquimbo to Chiloe. On the 7th, the center of the depression continued to move toward the southern region, and in the southern provinces rain continued intermittently during the 8th and 9th. As a result, there was a general rise of the rivers.

On the 10th, anticyclonic control was established over southern Chile, with a pressure maximum of 770 millimeters (1,026 mb.) at Valdivia. On the 11th, the center of high pressure moved toward the Argentine, and immediately thereafter took up a position between Cordoba and Buenos Aires.

On the 12th, a new depression overspread the southern region, causing rain, and on the 13th pressure began to rise in the south. The center of high pressure reestablished itself at Valdivia, with a maximum of 771 inches (1,028 mb.).

On the 14th, a great depression appeared in the latitude of Juan Fernandez. On the 15th, it affected the central zone of Chile, causing heavy rains and deep snows in the Cordilleran region, which interrupted trans-Andine traffic. On the 16th the snowstorm continued between Juncal and Bariloche; it rained in the central and southern parts of Chile. On the 17th the depression moved southward, and the rain in central Chile began to decrease.

During the 18th to 20th there was a temporary period of calm, with variable weather.

On the 24th and 25th an important depression caused rain in central and southern Chile; and, finally, between the 26th and 30th, a great anticyclonic center formed over southern South America, reestablishing fine weather.